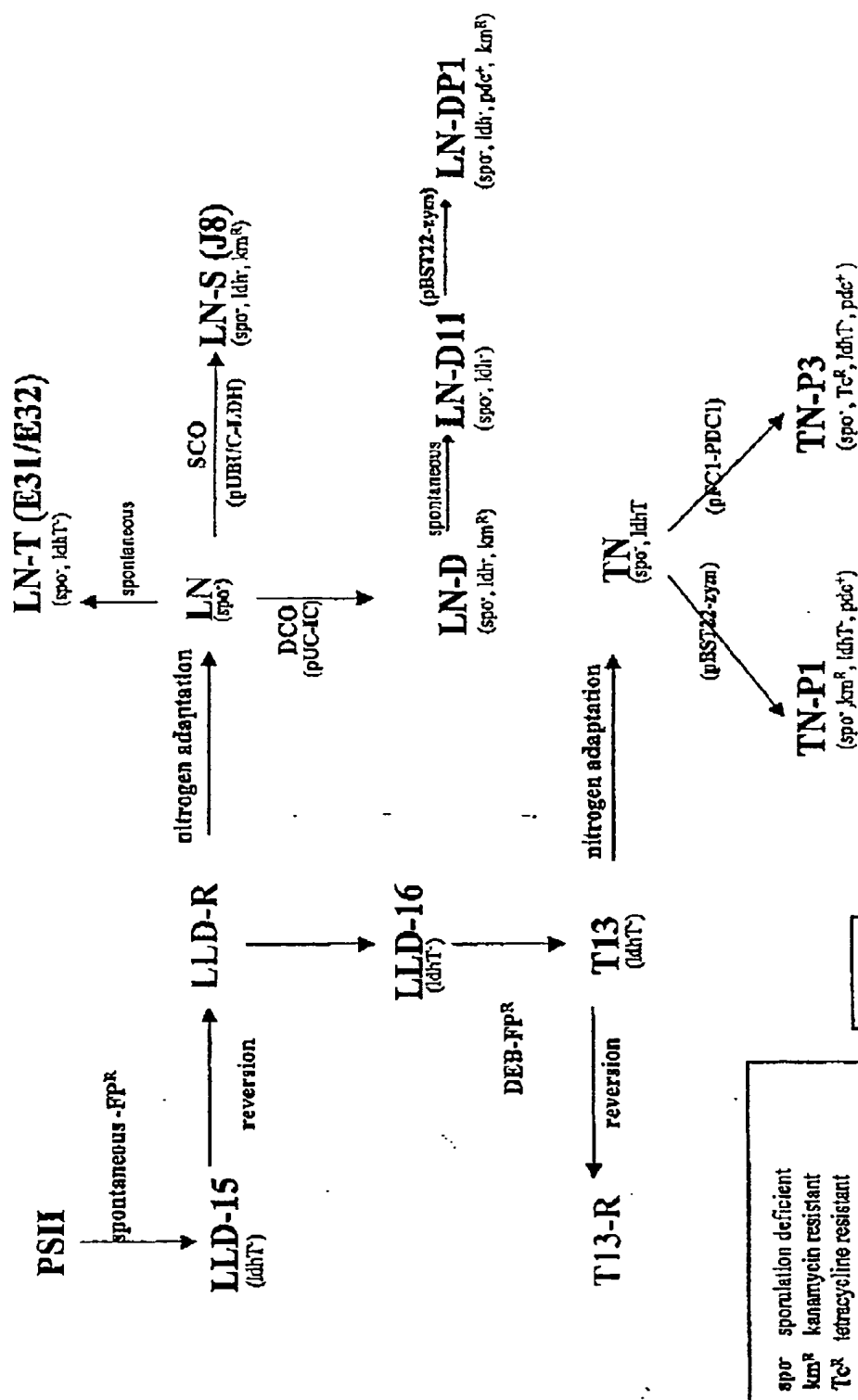


Figure 1

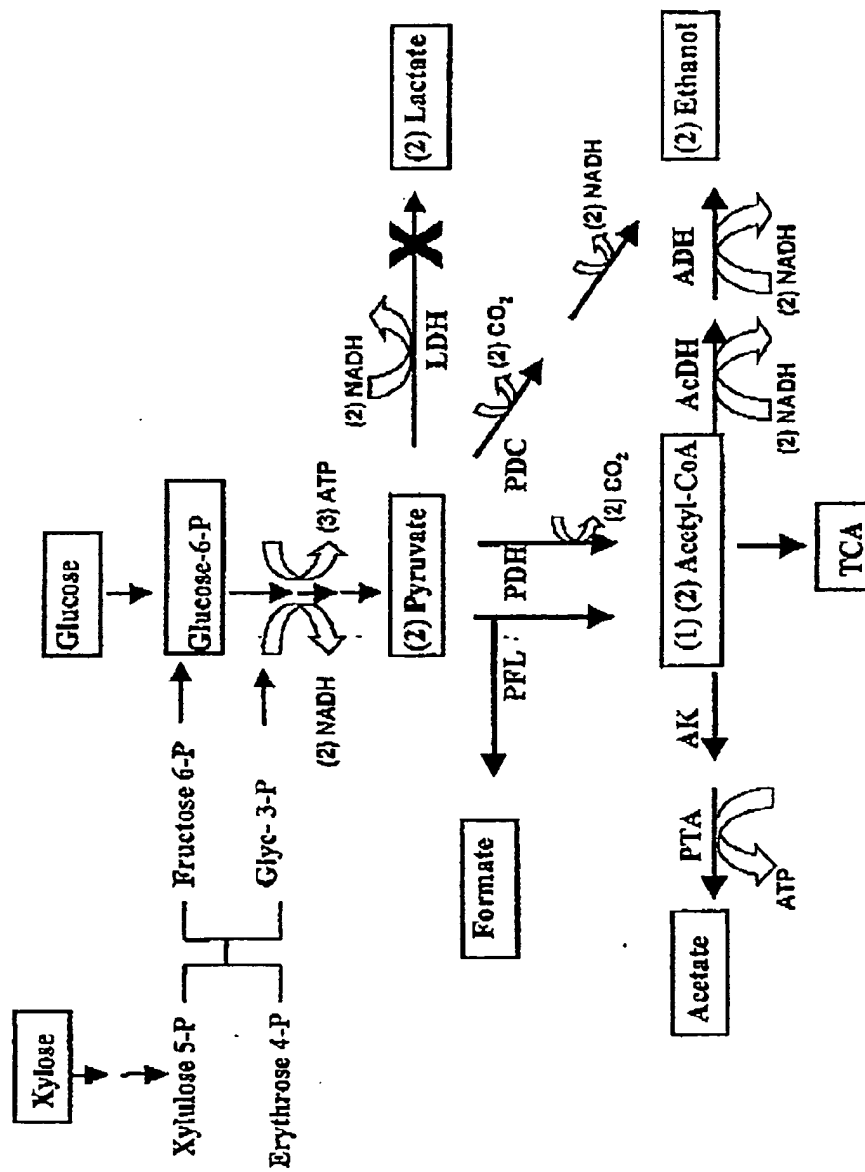
Ethanol Strain Development



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Sugar Metabolism to Ethanol

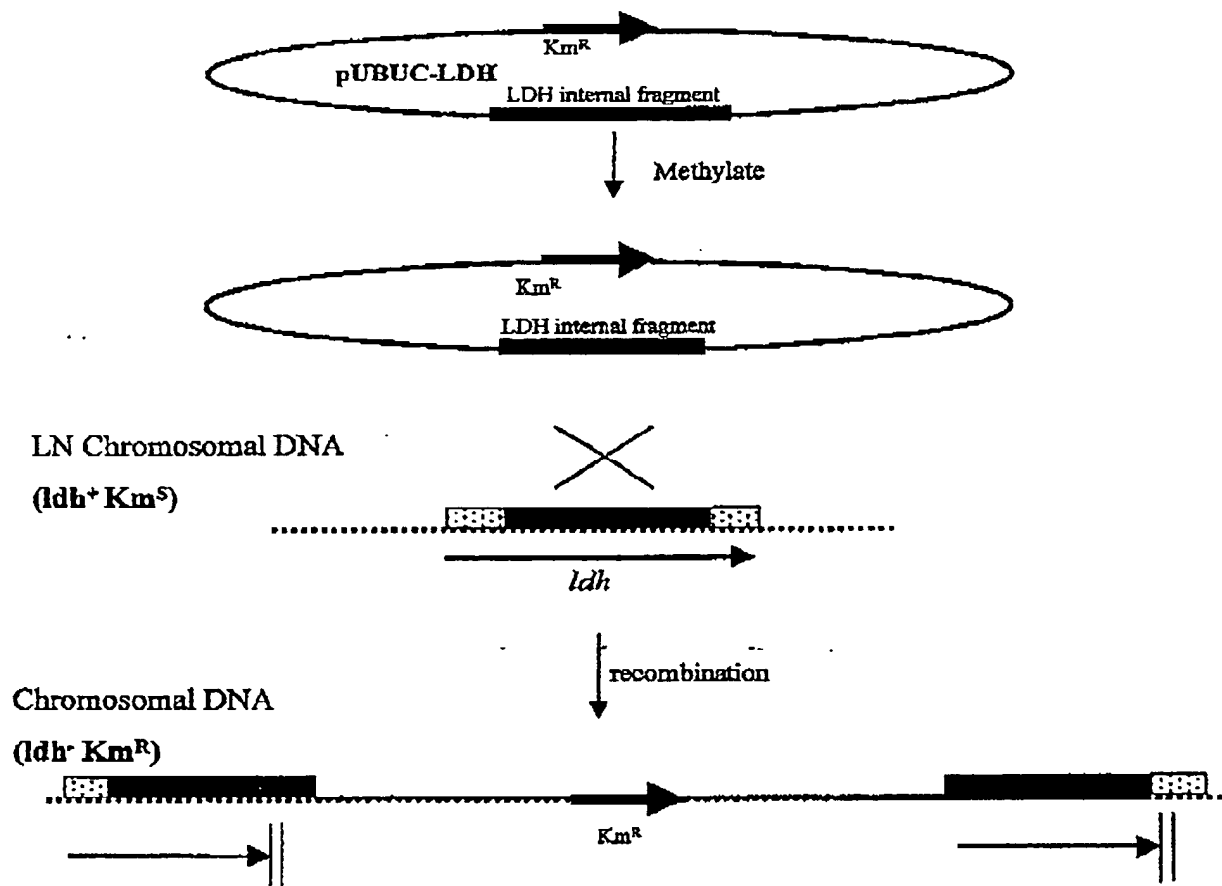
Figure 2



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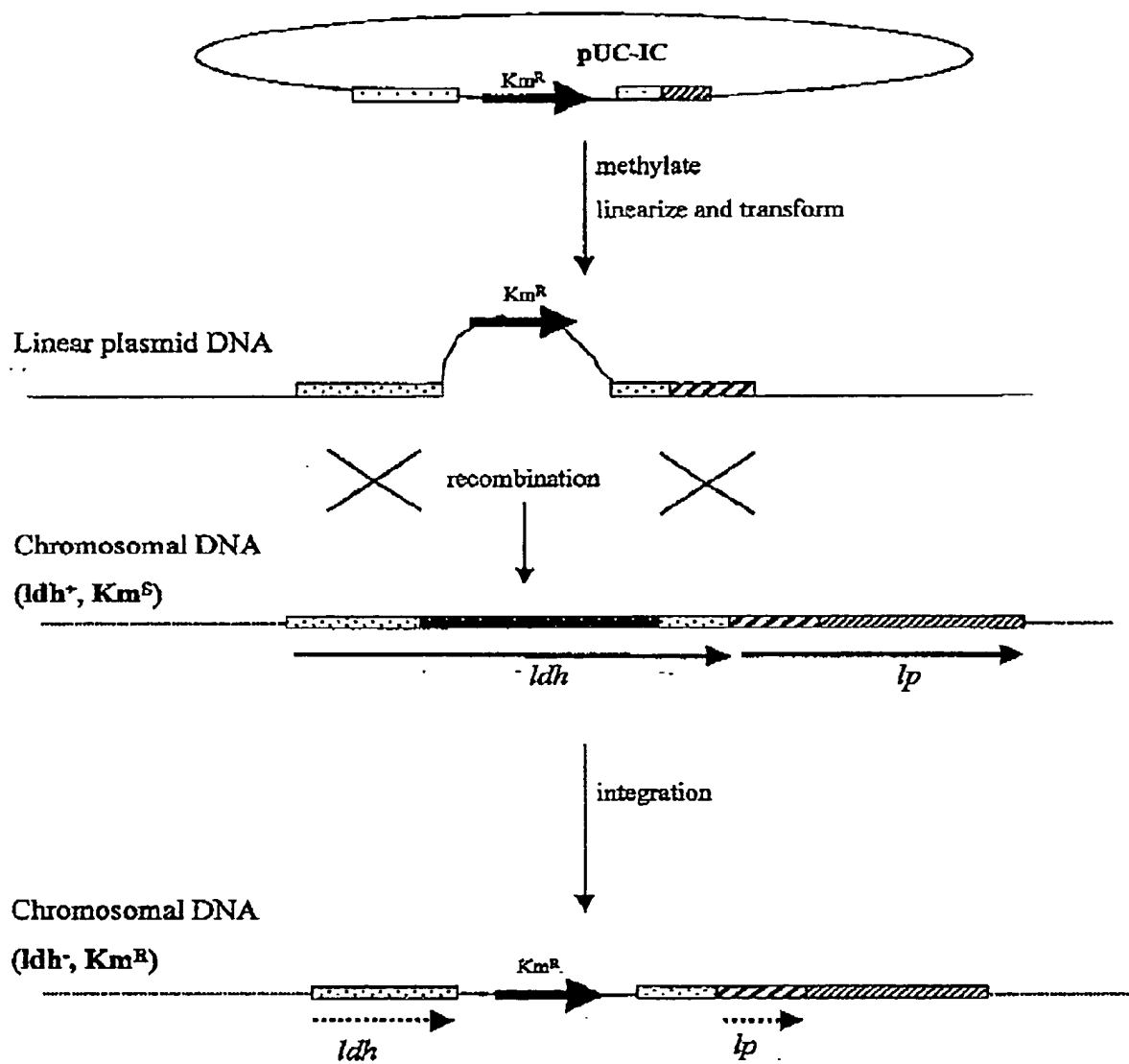
Figure 3

LDH Gene Inactivation by Single-Crossover Recombination



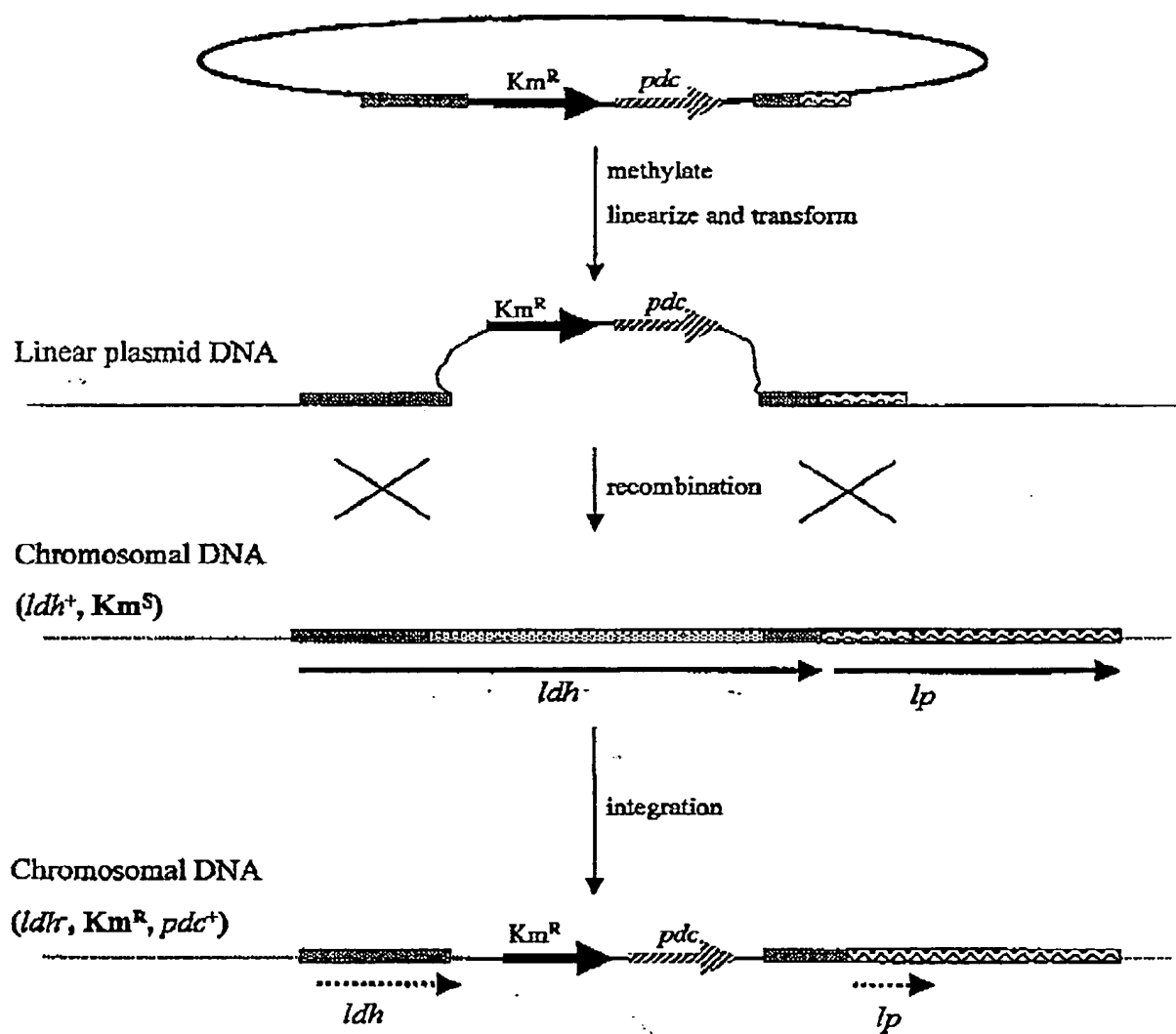
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Figure 4

LDH Gene Inactivation by Double-Crossover Recombination

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Figure 5

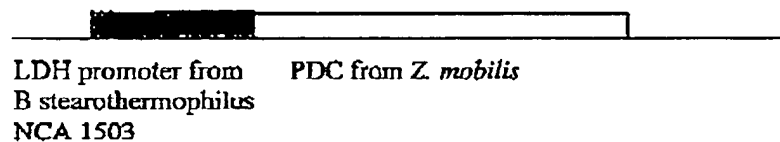
LDH Gene Inactivation and Heterologous *PDC* Gene Expression

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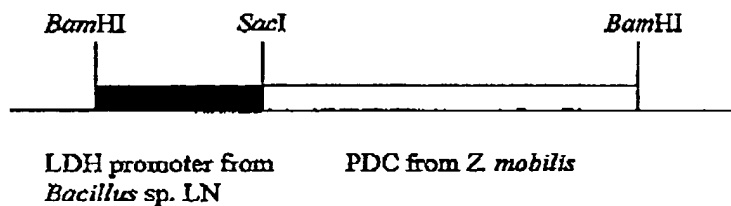
Figure 6

Expression of PDC

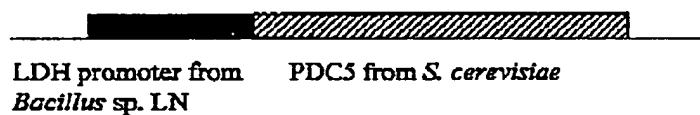
Construct 1 (cloned in pBST22)



Construct 2 (cloned in pFC1)



Construct 3 (cloned in pFC1)



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Figure 7. LDH promoter sequence from *Bacillus* LN

AGGGCAATCTGAAAGGAAGGGAAAATTCCTTTCCGATTCTCCTTTTAGTTATTTTATGG - 60
GCAGTGAATATTATATAGGCATTACGGAAATGATAATGGCAGAGTTTTTTCATTTATTAG - 120
ACTGCTTGATGTAATTGGATGTGATGATACAAAATAATGTGTGTAAACAAAATGTTAA - 180
CAAAAAGACAAATTTCATTCATAGTTGATACTTGATAAAGATTGTGAATAATGCACAA - 240
TATATCAATGTATGAGCAGTTTCACAAATTCATTTTTTGGAAAGGATGACAGACAGCG*AT - 300

G

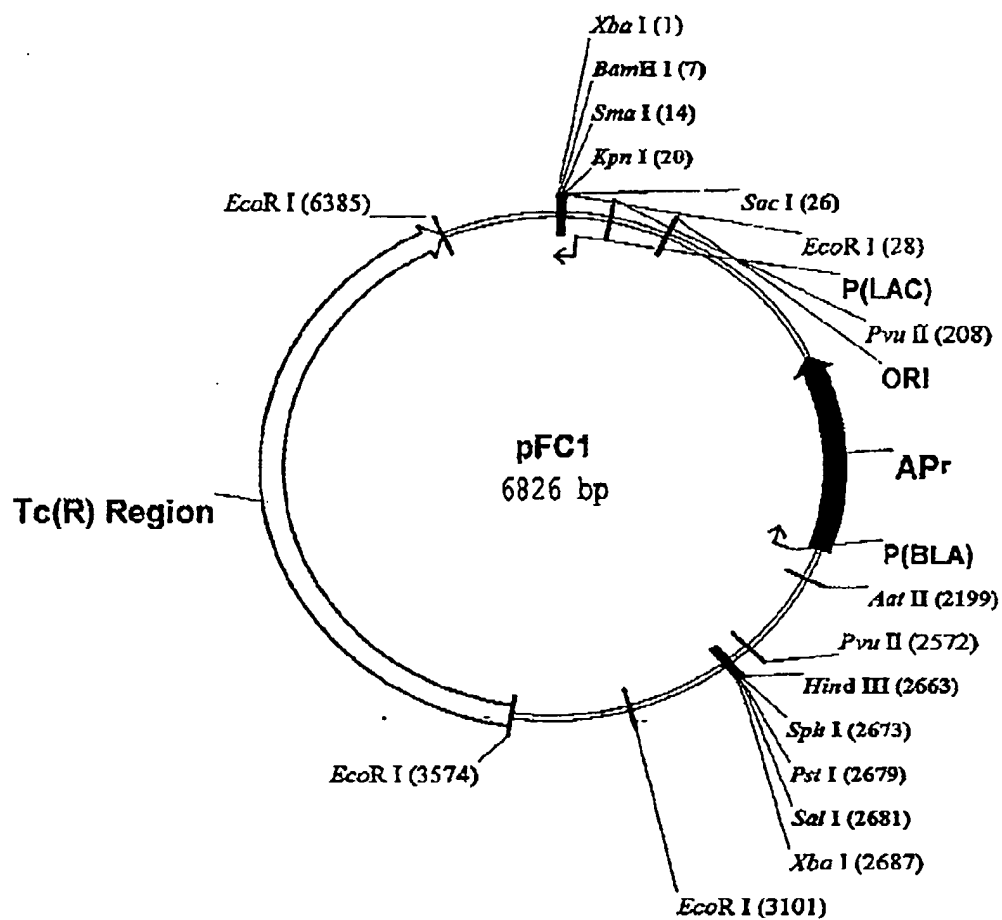
underlined: putative promoter sequences

bold: putative ribosome binding site

*: start codon

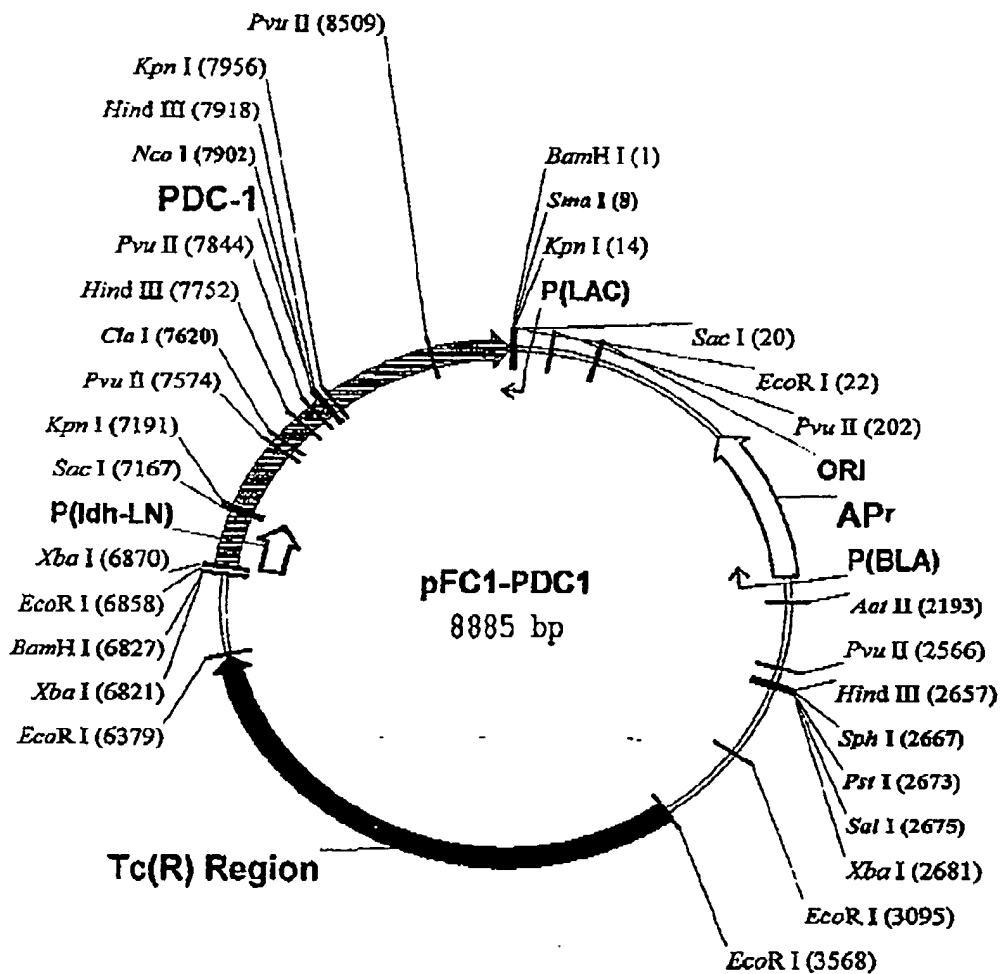
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Figure 8



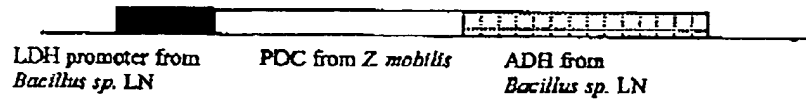
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Figure 9



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Figure 10

Construction of an Artificial PDC operon**Construct 4****Construct 5**